The DARWIN Interface to Aeronautics Data

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ABSTRACT
DARWIN is a distributed analysis tool that was developed at the NASA Ames Research Center to support aeronautics design activities across NASA.[1] By providing aircraft manufacturers with faster access to wind-tunnel data, the DARWIN system helps to shorten the aircraft design and test process. DARWIN applies the latest network technologies to link the wind-tunnel data systems to a secure meta-database and web server (MetaServer) that then distributes tunnel-testing results to the design customers. DARWIN's web-based, client-side interface provides users with powerful and customizable tools for reviewing and analyzing the wind-tunnel data.[5] Savings in time and money are realized for both the industry customers and the government when test engineers can efficiently access and interpret the results of wind-tunnel testing.

KEYWORDS
Wind-tunnel testing, worldwide web, network technologies, analysis tools.

INTRODUCTION
The DARWIN interface is comprised of a web browser, specifically Netscape Navigator™ v3.01 that can display HTML containing text, Javascript code, and Java applets, the DARWIN executive software, and supporting data analysis applications. The interface controls user authentication and privacy, data security, advanced video and interactive conferencing tools, remote control of cameras, interactive database access, and custom tools for data visualization and analysis.[5] The browser, and the applications are all resident on the client workstation. The web pages, which are the dynamic results of common gateway interface (CGI) scripts and Javascript functions, are retrieved from the DARWIN MetaServer via secure HTTP over the DARWINnet and AERONet communications network.[2]

ACCESS AND PREFERENCES
To access the DARWIN system, an engineer must have registered the IP address from which he will request data and have been issued a user name and password. He can then access tunnel data by using his web browser to log in to DARWIN's web site. DARWIN knows which tunnel tests each user has permission to view, and only displays data from allowed tests. All of the data displays are dynamically generated on the DARWIN MetaServer from the information available in the meta-database.

If a tunnel test is currently in progress, the user can monitor operations via a live-data screen. Tools incorporated into this screen include:

- Plots and tables that automatically update as new data come in.
- Live camera feeds showing the interior of the tunnel.
- Message board for posting notes to other user's of the system.
- Video conferencing tools that allow engineers at the tunnel and remote sites to communicate visually.
- Virtual-reality modeling of the current tunnel configuration.

These tools provide remote users with a clear picture of the wind-tunnel-test status.

For archival tests, the engineer can use the data review screen to retrieve data by posing queries to the database. The results can be displayed in two- or three-dimensional plots or in tables. For all plots and tables, the user can control and save her preferences for which data are displayed in the tables' columns and which variables are assigned to the x-, y- or z-axes of the graphs.

GRAPHICAL TOOLS
The two- and three-dimensional plotting is done by Java applets that were developed at Ames. Combinations of CGI script, javascript, and dynamic html[3] are used to make the screens interactive and customizable.

Not all wind tunnel data are numeric; several advanced instrument suites in use at Ames produce image files and other complex file formats. To review and analyze these data, several options are available to DARWIN users. For example, image files, such as those produced by pressure sensitive paint (PSP) tests, can be viewed four different ways:

- As single GIF-format images (with some loss of resolution from the original) within the user's web browser.
- As animated GIF images in a Java applet. The animation allows users to visualize slight changes between data points in a run.
- As original-format images in an advanced image-analysis tool called exVis.[4] Using exVis the engineer can manipulate color mappings, plot pressure chords, and perform other image-interpretation tasks.

- As a three-dimensional mapping onto a virtual-reality representation of the aircraft model. Using this tool, the engineer can see the pressure gradients applied to the model, which can be rotated and moved to any viewing angle or position.

USER-DEFINED STUDIES

Once the user has retrieved wind tunnel data and set up various plots, tables and data displays, she can save her work by creating a "study." The study is a description of all the variables needed to recreate the user's data analysis environment: which data were reviewed, which displays were applied, which preferences for columns, axes, color mappings, etc, were used. Once a study is saved, a link to it appears on user's login screen. Following the link will automatically retrieve the correct data and recreate the various displays.

The user can create multiple studies and can combine data from multiple tests in a single study. Once a study is created, the user has the option to share her work with colleagues using a documentation management system that allows files to be published for viewing by other specified users of the DARWIN system.

Experimental data may also be compared with computational fluid dynamics (CFD) simulations retrieved from a results database.

CONCLUSION

The DARWIN interface provides innovative, timely access to wind-tunnel test data. Users can rapidly retrieve information and apply a variety of data analysis tools to aid interpretation of the results. The customizable environment allows users to monitor data collection while a tunnel test is in progress and to post-process archival data. It is equally easy to use the DARWIN interface whether the engineer is physically in the tunnel or at the industry customer's home offices. All that is needed is a connection to NASA's secure networks and a commercial web browser. The customer saves both time and money when fewer engineers are required to be physically present at the tunnel test and when those engineers can quickly and efficiently access and interpret the results of the test.

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